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The Effect of Regulation on Broadband Markets: Evaluating the Empirical Evidence in the FCC's 2015 "Open Internet" Order

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Abstract In 2015, the Federal Communications Commission (FCC) imposed common carriage regulation—so-called Title II requirements—on previously unregulated broadband Internet service providers. The regime shift was premised on the FCC's findings that such rules had demonstrably yielded economic gains. This paper evaluates the FCC's empirical arguments and finds them uncompelling. Adjustments for inflation or general economic trends eliminate the effects cited by the FCC. Moreover, contrary to the Commission's assessment, mobile services and broadband markets have shown notable growth in response to deregulatory events that *reduce* Title II requirements.

Keywords Network neutrality · Vertical foreclosure · Broadband regulation

1 The FCC'S 2015 "Open Internet" Order

In 2015, U.S. telecoms regulators dramatically shifted a generation of public policy with respect to the Internet. Since the early 1960s, the Federal Communications Commission (FCC) promulgated rules that effectively quarantined traditional common carrier regulations to "basic" or "telecommunications" services. This approach allowed "enhanced" or "information" services to develop without the restrictions and obligations (including payments to the Universal Service Fund) that

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had traditionally been imposed under Title II of the 1934 Communications Act. The Commission argued this was to encourage investment and experimentation, and to bring innovative networks and applications into the marketplace. These evolving services are inherently difficult to regulate because the form, utility, and economic value of newly emerging technologies are uncertain.

The policy of open markets for information services worked well, according to a 1999 FCC staff paper that reviewed the historical policy arc:

> The story of the Commission and its role in the development of the Internet highlight the benefits of the FCC's early deregulatory efforts to facilitate the growth of computer applications offered over the public telecommunications network… [T]he Commission has acted in numerous ways to ensure that this incredible network of networks continued to develop unregulated… (Oxman 1999, p. 6).

Specifically, the Commission excluded evolving data networks from common carriage rules that had been imposed on telephone carriers under Title II of the 1934 Communications Act. As the paper continued:

> When innovative new IP [Internet Protocol] communications services first entered the marketplace, the Commission had already firmly established its deregulatory approach. The FCC did not seek to apply legacy Title II regulations to the Internet as it developed and flourished – the first email programs in the 1970s, interactive newsgroups in the 1980s, and the World Wide Web in the 1990s all grew up over the nation's telephone lines free from regulation (Oxman 1999, p. 24).

The FCC veers sharply from this path in its 2015 Open Internet Order (OIO2). Instead of seeing regulatory forbearance as key to encouraging innovative activity to spur investment in networks and competition in services, the Commission now sees the emergent landscape as dotted with "gatekeepers" and "terminating monopolies" in the form of broadband Internet service providers (ISPs) (FCC 2015a, b, par. 80). The Order adopts "bright-line rules" that prohibit "paid prioritization," where ISPs and content providers contract for quality-of-service levels that may include faster delivery to end users. It also bans "blocking" access for end users (restricting the content of certain websites) and "throttling" access for end users (partially restricting the content of certain websites). These rules apply to "both fixed and mobile broadband" ISPs (FCC 2015a, b, par. 110). The blocking and throttling bans are conditional on the content in question being "legal" and "non-harmful" (*Id*., par. 115), and ISPs are still permitted to engage in "reasonable network management" (*Id*., par. 112). This presumably allows the blocking of malware, viruses, spam, and communications traffic seen as highly deleterious to subscribers.

The 2015 rules were controversial.[1] A 2016 verdict of the U.S. Court of Appeals upheld the rules on a 2–1 vote (USTA 2016). The opinion generated a vigorous dissent (USTA Dissent 2016). The new rules stem from "network neutrality"

[1] "The air in Washington is alive with contending voices that are taking sides on these issues" (Owen 2011, p. 381).

regulations that were long championed (e.g., Wu and Yoo 2007) and were twice imposed in slightly different forms by the FCC. A federal court overturned the 2007 Comcast Order in 2010 (*Comcast* 2010). The same court set aside the 2010 Open Internet Order (OIO1) in 2014 (*Verizon* 2014). The Commission's 2015 OIO2 rulemaking put forward similar rules to those adopted in OIO1, but offered a new legal justification for re-classifying broadband networks as "telecommunications services," therefore subjecting them to the Title II common carrier obligations. The justification offered for this reform—referenced by both commentators and FCC members as "the nuclear option" (FCC 2015a, b, p. 389)—was premised on economic theory and evidence. The Administrative Procedures Act requires that a regulatory commission "examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'"[2]

1.1 Theory

The argument that drives network neutrality rules is that broadband ISPs enjoy endemic market power. They are "terminating access monopolies"[3] that can impose inefficient restrictions on their subscribers. In particular, ISPs can control prices or otherwise regulate the flow of services that are available from complementary producers over the ISP's broadband network—a form of vertical integration by contract. If undertaken for anti-competitive purpose and achieving anti-competitive effect, it would be deemed vertical foreclosure in economics (or under antitrust law).

Of course, vertical integration (including coordination between input suppliers and their downstream partners) is ubiquitous throughout the economy and in most cases is overwhelmingly efficient and provides net benefits to consumers (Cooper et al. 2005; Lafontaine and Slade 2007). "The concern," writes Owen (2011, p. 381), "is with vertical integration that may give firms both the opportunity (through denial of access or price discrimination) and incentive (increased profit) to restrict competition."

To differentiate pro-competitive from anti-competitive vertical arrangements, antitrust law uses a "rule of reason" adjudication framework that weighs costs and benefits, and recognizes possible losses from enforcement errors that go in either direction (Manne and Wright 2010). In this analysis, market power is generally a necessary but not sufficient condition for vertical conduct to result in competitive harm. It is both necessary and sufficient, as a matter of antitrust economics and law, that consumer harms with regard to conduct are in evidence, and that the expected social gains from the proffered legal remedy exceeds its risks. This implies that the existence of an intermediary—also known as a "gatekeeper"—resolves the policy question. It is important to show that harms result, given market structure and firm

[2] *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) [quoting *Burlington Truck Lines v. United States*, 371 U.S. 156, 168 (1962)]. See also, FCC (2015a, b, p. 387).

[3] The term, used in a Comment filed at the FCC by Netflix, is used in FCC (2015a, par. 200, fn. 505).

behavior, and that policies to create alternative outcomes create consumer welfare gains.

1.2 Evidence

Evidence about how the practices that are targeted (blocking, throttling, paid prioritization) by the FCC's Order impact market outcomes is essential to establishing a credible case for implementing new rules. Former FCC Chief Economist Gerald Faulhaber writes that "the economics literature does not support net neutrality (absent empirical evidence demonstrating actual bad behavior)" (Faulhaber 2015, p. 51). He specifically notes "[e]mpirical analysis is required to determine, in any particular circumstance, whether paid prioritization is helpful or harmful. No such evidence has been produced, either in the literature or in the FCC order" (*Id*., p. 52).

A key issue on which the FCC does opine relates to the impact of common carrier (Title II) regulation on broadband investment. "Many experts have suggested that Title II regulation will dampen investment in both networks and edge providers," notes Faulhaber. The FCC "dismisses this, claiming that investment in wireless networks has held up despite the announcement of Title II. That is just happy talk that supports similar language in the new order" (*Id*., p. 53).

We shall examine the claim—or "happy talk"—in more detail below. We here note that the Commission's 2015 Open Internet Order does not include references to any empirical studies that evaluate, let alone establish, the empirical propositions that the agency advances as justification for new Title II rules. Listing circumstances in which firms may possibly resort to vertical foreclosure is not the same as offering evidence that it has happened, will happen in the future, or would be successfully countered by rules designed to offset the anticipated action.

The consumer harm that Title II hopes to prevent is still largely speculative, as is the efficacy of Title II regulations as a potential remedy. Commissioner Pai described the FCC's Title II decision as "a solution that wouldn't work to a problem that doesn't exist" (Pai 2016, p. 1).

In 2010, the FCC offered that, "we… disagree that we have acted on 'speculative harms alone,'" (FCC 2010, par. 23, fn. 60). The Commission cited one paper to refute the disputed charge: Goolsbee (2007). "The Goolsbee Study provides empirical evidence that cable providers have acted in the past on anticompetitive incentives to foreclose rivals, supporting our concern that these and other broadband providers would act on analogous incentives in the future."

The FCC's sole citation is rich with implication. In fact, the paper examined vertical integration in cable TV programming and distribution markets, which suggests that the Commission could not find any economic study to back up its empirical claims with respect to the broadband market. Moreover, Goolsbee explicitly warned against using its econometric results to infer that anticompetitive discrimination had occurred or advanced as the basis for formulating public policy: The statistical exercise was "obviously meant only to be suggestive" (Goolsbee 2007, p. 30).

But most fundamentally, the actual evidence in the analysis does not suggest that cable TV operators engaged in vertical foreclosure. Indeed, Goolsbee's empirical results indicate that, on average, *operators have discriminated against the programming services that they owned—the opposite of vertical foreclosure* (Hazlett and Wright 2012, pp. 813–834). This paradoxical outcome begs explanation, supplied in an examination of the model employed. At bottom, the FCC's interpretation of this research is wholly inappropriate as support for the policy reforms advanced.

The FCC's 2015 Net Neutrality Order does not respond to criticism of its exclusive reliance on the Goolsbee study to establish that vertical foreclosure is a phenomenon in broadband markets worthy of regulation; nor does it establish that broadband markets exhibit any of the traditional forms of market failure that may in some circumstances require regulation (Wright 2015, pp. 5–8). Rather, the 2015 Order eliminates any reference to Goolsbee (2007) and does not cite any cost-benefit analysis of U.S. broadband markets to justify the Commission's reforms.

The Order does reference several theory articles, however, written between 1983 and 2000, for the proposition that price discrimination may be used in an anticompetitive strategy (FCC 2015a, b, par. 126).[4] The theory is misinterpreted, as one of the cited authors has explained (Katz 2016). More deeply, the theoretical possibility of such behavior is not at issue. The question is whether that theory fits the facts of the existing broadband market, and whether the effective way to counter such strategies is via ex ante rules for network neutrality via Title II regulation. The lack of systematic empirical research on vertical foreclosure, and on the effectiveness of regulation to counter it, makes the FCC's assertions regarding the broadband marketplace all the more crucial. We evaluate four of the Commission's claims:

(a) Capital investments made by broadband ISPs went up following the imposition of the 2010 network neutrality rules.
(b) FCC wireless auction No. 97, which registered relatively high bids for AWS-3 licenses in January 2015, demonstrated that there was no depressing effect on network investment due to FCC network neutrality rules.
(c) Since the 1980s, mobile markets have developed under "light touch common carrier" regulation that establishes the pro-efficiency basis of such rules, which are said to be analogous to the FCC's 2015 OIO2 Title II re-classification (for fixed and wireless broadband services).
(d) The application of Title II rules to DSL and Fiber-to-the-Premises networks encouraged broadband deployment.

We evaluate these four empirical assertions one at a time, and then provide a summary of arguments in the Conclusion. In short, each of the claims is dubious. In total, the facts that are cited by the Commission provide no plausible case for Title II regulation of U.S. broadband networks.

[4] The papers are Katz (1983, 1984, 1987), Brock (1986), Yoshida (2000).

1.3 Broadband ISP Capital Expenditures (Capex)

> Four years ago, the Commission adopted open Internet rules to protect and promote the "virtuous cycle" that drives innovation and investment on the Internet… In the years that those rules were in place, significant investment and groundbreaking innovation continued to define the broadband marketplace. For example, according to US Telecom, broadband providers invested $212 billion in the three years following adoption of the rules—from 2011 to 2013—more than in any three-year period since 2002. Likewise, innovation at the edge moves forward unabated (FCC 2015a, par. 2).

The issue as to whether Title II classification for broadband networks produces consumer gains is intimately connected to the capital investment (capex) question. Should rules on networks entice immediate gains—expanding access for end users to more Internet content—but undercut long-run investment incentives, the purported benefits could be illusory.

The capex issue has been addressed in the net neutrality policy debate by no less than the U.S. Department of Justice (DOJ) Antitrust Division. In 2010, it advised the FCC to tread lightly in applying new regulatory rules so as not to reduce incentives for new network investment:

> Although enacting some form of regulation to prevent certain providers from exercising monopoly power may be tempting with regard to… areas [that are served by only one or two broadband providers], care must be taken to avoid stifling the infrastructure needed to expand broadband access. In particular, price regulation would be appropriate only where necessary to protect consumers from the exercise of monopoly… (DOJ 2010, p. 28).

The admonition from the DOJ is not historically surprising. The long-stated rationale for deregulating "information services" is that traditional common carriage rules suppress their emergence without providing sufficient offsetting benefits (Kellogg et al. 1999). Hence, it is important that the Commission, in advancing new rules in the 2015 Open Internet Order (OIO2), offers an empirical assessment that purports to establish the opposite causal relationship. In the passage that was quoted above, it connects the 2010 Open Internet Order (OIO1) (unveiled at the very end of the year) with a positive response in ISP capex: the highest level of investment, over 2011–2013, for any such period in a decade. The Commission connects this increase to the announced rules, which are asserted to have supported a "virtuous circle."

The FCC's proposed test is theoretically weak. While the FCC did adopt net neutrality rules at the end of 2010, the rules were immediately challenged in federal court. Complaints under the rules were tabled until the litigation was decided. Ultimately, and not particularly surprisingly, the D.C. Circuit overturned the rules (Verizon 2014). So, the idea that the market had a strong reaction to the 2010 rules, and adjusted according to new expectations—either with respect to a "virtuous circle" or added enforcement costs—is debatable.

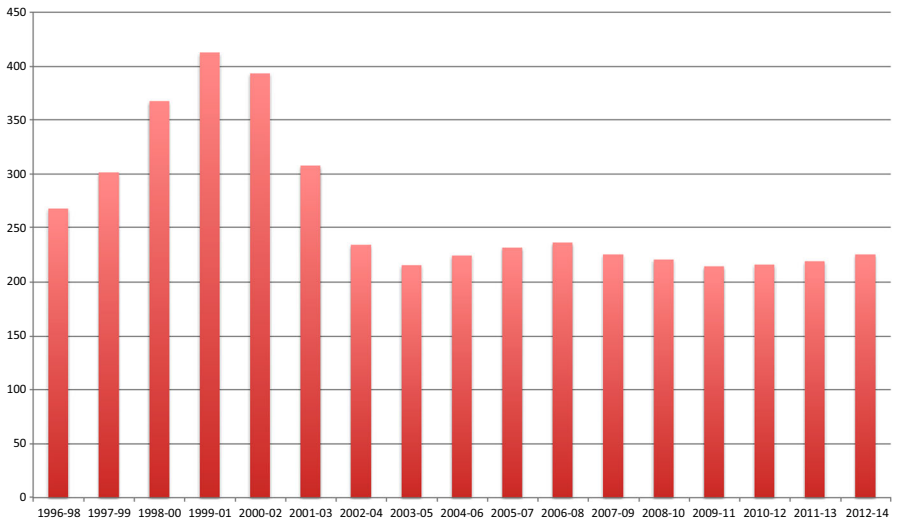

Fig. 1 3-Year rolling average broadband capex (2014 dollars, bil.)

Nonetheless, the Commission's empirical approach is to observe, without any trend or other adjustment, capital invested by ISPs in one three-year period (2011–2013). It concludes that the level of capex in this period is historically high. However, by simply adjusting nominal outlays by the GDP Deflator, a standard measure of economy-wide inflation, the asserted result vanishes. Of sixteen data points, rolling three-year averages from 1996–1998 through 2011–2013, 12 values for capex are higher than the 2011–2013 figure, only three values lower (Fig. 1).[5]

Two more simple adjustments further reveal how the FCC's empirical assessment is unwarranted—calculating annual ISP capex spending as a ratio to U.S. GDP and then as a ratio to the S&P500 Index. These measures incorporate changes that account for overall economic growth, on the one hand, and for the change in capital values (throughout the economy), on the other. In Figs. 2 and 3 it appears that the 2011–2013 period was not associated with any notable uptick in trend insofar as the "virtuous circle" of Internet investment is concerned.

These impressions are supported by running simple regressions to calibrate the change in capex over the 2011–2013 period (using 3-year moving averages). As shown in Table 1, there are no statistically significant changes in ISP investment post-2010. And, using the FCC's unadjusted model, the relationship that is associated with the 2011–2013 period is—while not statistically significant—*negative*. The best that can be said for the FCC's analysis is that it is uncompelling. Even the bare bones framework that is adopted by the FCC shows no positive reaction of ISP capex following the 2010 net neutrality rules.

[5] The source of the data is the same as that utilized in the FCC's analysis. U.S. Broadband Provider Capex, U.S. Telecom: The Broadband Association; https://www.ustelecom.org/sites/default/files/images/Historical-Broadband-Provider-Capex-072015.png. Adjusting by the Consumer Price Index (All Urban Consumers) makes the 2011–2013 level the third-lowest capex for the sample period.

Fig. 2 ISP Capex/GDP

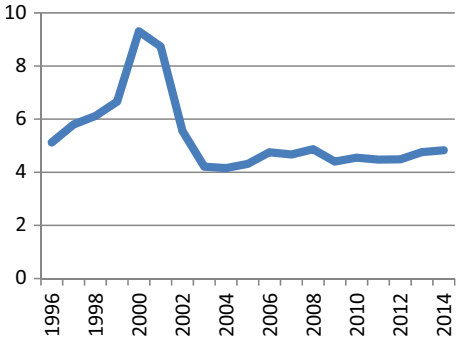

Fig. 3 Capex/S&P500 index (×100)

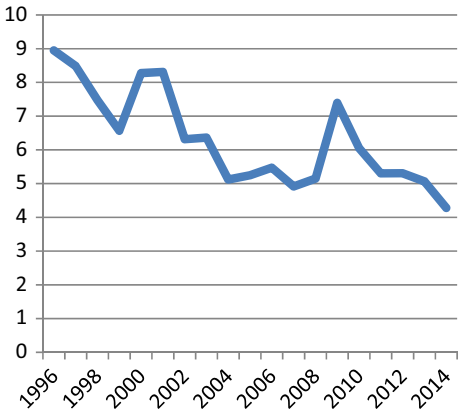

Table 1 Coefficient estimates for OLS regressions on annual U.S. broadband investment, 1996–2013 (*p* values in parentheses)

	(1) FCC model	(1B)	(2) GDP deflator adjusted	(2B)	(3) S&P500 index adjusted	(3B)	(4) GDP adjusted	(4B)
Constant	221.0625	248.16	90.35	110.67	6.523	8.406	5.503	6.768
	(0.000)	(0.000)	(0.000)	(0.000)	(0.0000)	(0.000)	(0.000)	(0.000)
Year trend		−3.165		−2.338		−.2167		−.1456
		(0.141)		(0.056)		(0.000)		(0.043)
2011–2013 DUMMY	−9.0625	14.48	−17.239	2.199	−1.299	.5024	−.9292	.2808
	(0.829)	(0.737)	(0.282)	(0.899)	(0.152)	(0.481)	(0.324)	(0.781)
R^2	0.0032	.1507	.0678	.263	.1169	.6263	.0571	.2766

2 Mobile Services

> History demonstrates that this careful approach to the use of Title II will not impede investment. First, mobile services have been regulated under a similar light-touch Title II approach since 1994 – and investment and usage boomed. For example, between 1993 and 2009 (while voice was the primary driver of mobile revenues), the mobile industry invested more than $271 billion in building out networks, during a time in which industry revenues increased by 1300 percent and subscribership grew at over 1600 percent (FCC 2015a, par. 39).

The FCC argues that there is evidence that Title II regulation encourages—or at least does not impede—market development in mobile services. The immediate problem is clear: While the agency claims that the 1993–2009 "light-touch Title II" regulation applied to mobile services are "similar" to the rules that are being applied in the new regulations, they are not identical. The point of the "open Internet" rules is to prohibit at least some of the business models and practices that were adopted under the "light-touch Title II" and thereby—according to regulators—improve market outcomes.

This argument has been asserted repeatedly over the past decade. Wu (2007) argued for a "Wireless Carterfone" (referring to the 1968 FCC decision that restricted the ability of wireline carriers to prevent consumers from attaching their own devices to the network) on the grounds that the common carrier rules that applied to fixed line telephony (under Title II) were insufficiently applied to mobile carriers. (See also, Frieden 2008; Hahn et al. 2007.) That argument found some receptiveness at the FCC, which imposed "open access" rules on the 700 MHz C block licenses that were auctioned in 2008, and in the 2010 OIO1.

However, the 2010 net neutrality rules did not apply the same rules to mobile broadband carriers as to fixed operators on the grounds that mobile networks presented "special considerations" (FCC 2010, par. 94). While regulations were "for the most part as applicable to mobile broadband as they are to fixed broadband" (*Id*., par. 93), the FCC chose to reduce regulatory requirements for the former. It did so, not only because subscribers generally faced a greater number of competing suppliers (*Id*., par. 95), but because mobile business models were in flux and the "earlier-stage platform… rapidly evolving" (*Id*., par. 94). Moreover, the constraints of wireless service meant that determining the nature of "reasonable network management" practices was more complicated (*Id.,* par. 95).

The FCC's 2010 reasoning reflected the long-standing policy paradigm of deregulation in wireless. In 1991, the carrier Fleet Call (later, "Nextel") was granted the right to be a "private carrier" and to use spectrum that had been assigned to its Enhanced Specialized Mobile Radio (ESMR) licenses flexibly, "beyond the reach of Title II requirements" (Huber and Leo 1997, p. 815). Because this (and other) deregulation was skewing competition in the mobile market, Congress stepped in and, in 1993, required that all mobile licenses be subject to Commercial Mobile Radio Service (CMRS) rules.

While these changes technically returned licensees to Title II, the legislation granted "the Commission the freedom to deregulate across the board" (*Id.*). It did:

> Pursuant to Congressional mandate, the Commission accordingly announced that it would forbear from applying rate regulation and other Title II requirements to all forms of CMRS providers. The Commission also broadly pre-empted state regulation of wireless rates (*Id.*, footnote omitted).

The Chairman of the FCC, Reed Hundt, described the situation: "by auctioning spectrum with no rules attached and preempting all state regulation, we had totally deregulated the wireless industry" (Hundt 1999, p. 98). The 2015 Commission claims that "investment and usage boomed" in the ensuing period, and associates this outcome not to "totally deregulating" wireless but to Title II rules. There is no evidence for that parsing of the data. The Commission ignores, however, an obvious test of common carriage regulation. The Omnibus Budget Reconciliation Act of 1993 pre-empted state-level rate regulation. About half the states had maintained some tariffing provisions, and they were given one year to file a petition (with the FCC) that stated, in public interest terms, why it should be allowed to continue. Seven states filed petitions to keep their rate control regimes; the FCC denied all seven (Huber and Leo 1997, p. 816). By year-end 1994, no cellular rates (retail or wholesale) were subject to price regulation.

There was no post-regulation price jump. Indeed, prices, which averaged over fifty cents a minute in 1993, fell precipitously beginning in 1994. See Fig. 4. Adding two broadband PCS licenses per market following FCC Auction No. 4 (which concluded in March 1995) increased competition and expanded capacity (Hazlett 2003). A test of common carrier regulation was embedded, however, not in the reaction of the market to new licenses, but in the immediate impact on prices when common carrier rate regulation was lifted in 1994. Analyses performed by Shew (1994), Hausman (2002), Hazlett (2003), Duso (2005) and Boliek (2009), found that prices tended to increase with rate regulation and to decline with the pre-emption of rate regulation. As mobile markets transitioned away from common carrier rules, prices fell and output expanded. The FCC attributes to "light touch Title II regulation" what was evidently the product of deregulation.

3 DSL and Fiber-to-the-Premises

> Title II has been maintained by more than 1000 rural local exchange carriers that have chosen to offer their DSL and fiber broadband services as common carrier offerings. And, of course, wireline was regulated as a common-carrier service until 2005 – including a period in the late '90s and the first five years of this century that saw the highest levels of wireline broadband infrastructure to date (FCC 2015a, b, par. 39; footnotes omitted).

The FCC appeals to allegedly robust deployments of advanced data networks in two episodes to establish that Title II has not deterred investment in broadband. In fact,

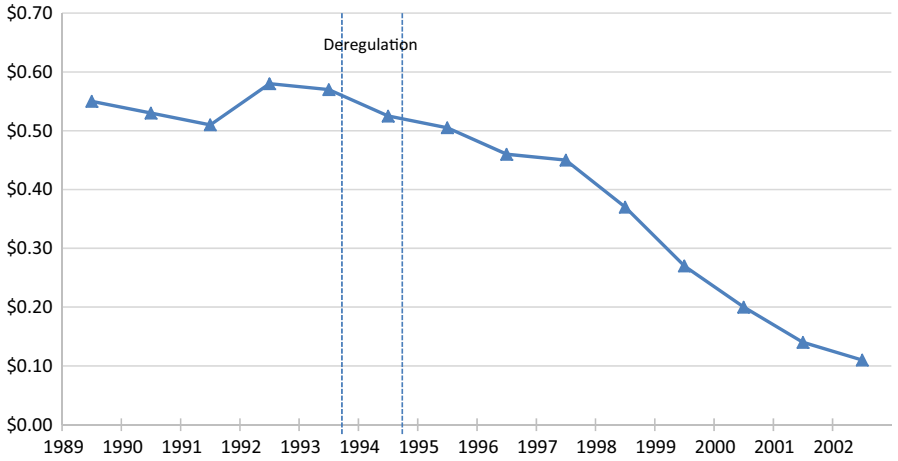

Fig. 4 Average cost-per-minute, U.S. retail mobile services, 1989–2002 (Hazlett 2003, 214.)

the Commission elsewhere interprets its evidence to suggest just the opposite. In 2011, the agency found that

> [T]oo many Americans do not have access to modern networks that support broadband. Approximately 18 million Americans live in areas where there is no access to robust fixed broadband networks… There are unserved areas in every state… [and] there is little reason to believe that Congress' desire 'to ensure that all people of the United States have access to broadband capability' will be met any time soon with current policies (FCC 2011, par. 4; footnotes omitted).

This finding and bemoaned the "rural–rural divide" wherein "parts of rural America have no broadband access, because the existing program fails to direct money to all parts of rural America where it is needed" (*Id*., par. 7). The program referenced is the Universal Service Fund (USF), specifically the High Cost Fund (HCF). Despite the HCF's expenditure of more than $41 billion between 2001 and 2012 (GAO 2012, p. 15), the federal government has found both voice and data services deficient in rural areas. This resulted in a $7 billion "broadband stimulus" allocation, made by Congress in 2009 (Rosston and Wallsten 2014), and then led the FCC to shift its HCF subsidies to support data (not just voice) services in 2011, the FCC setting an annual budget of $4.5 billion for the purpose (GAO 2012, p. 9).

Whatever services the "more than 1000 rural local exchange carriers" under Title II provide, their unsubsidized deployments are deemed to be lacking. Thus, the FCC's actions imply that it believes that the incentives to invest under Title II are not producing broadband deployments comparable to those in other markets where Title II requirements were eliminated by 2005.

However, given the variance in the application of Title II rules over time, an empirical test with greater explanatory power is available. Title II applied to telephone carriers' DSL services until 2005, but did not (ever) apply to cable TV

companies' broadband services. That policy difference was a source of controversy from at least 1998 (Esbin 1998; FCC 2002) with the FCC electing (until the 2015 OIO2) not to impose such regulatory requirements on cable TV operators. Indeed, when the U.S. Supreme Court in 2005 upheld the deregulatory policy for cable modem service (*Brand X* 2005), policy makers eliminated Title II rules for telephone carrier-supplied broadband services. This ruling followed an important Commission decision in February 2003 that substantially eliminated the wholesale access requirements by restricting "line sharing" in setting rates paid to incumbent telephone companies for the use of their DSL facilities.

The policy history is informative. In 1999, the FCC issued a report that evaluated burgeoning broadband services. It found that unregulated cable TV operators were vertically integrating into data services. Specifically, "cable broadband rollout has spurred the deployment of digital subscriber lines (DSL)…" (FCC 1999, p. 9). In other words, the platform without Title II rules was forcing technological innovation by the platform with Title II rules. The Commission credited cable's unregulated status as an important factor in delivering this encouraging outcome: "One of our most significant preliminary findings is that the Commission's policy of restraint on broadband regulation has helped to create a fertile environment for growth" (*Id.*, p. 46). The FCC sought to keep cable modem service unregulated explicitly so as "to remove regulatory uncertainty that in itself may discourage investment and innovation" (FCC 2002, par. 5).

The rejection of Title II or other "open access" requirements for cable systems was hotly contested (Picot and Wernick 2007). It brought predictions of doom, including the claim that the policy "causes irreparable harm to competition, consumers, thousands of independent ISPs and the structure of the global internet itself" (Comstock and Butler 2000, p. 6). The proposition is testable, and the test is made richer by telco-provided DSL joining cable modem services following the FCC's deregulatory actions in early 2003 and mid-2005. The pattern of regime change can be categorized as in Table 2.

Hazlett and Caliskan (2008) analyzed deployment differences (focusing on subscribership) across the two platforms and through the various regulatory regimes. Cable modem service, never regulated, led the early broadband market, as the FCC noted. DSL trailed, achieving only about one-half the uptake (Fig. 5). The situation changed dramatically, however, following the FCC's 2003 (first quarter) elimination of "line sharing" rules that had been imposed on DSL networks: the trend in DSL subscribership sharply increased relative to cable modem Internet

Table 2 Regulatory regimes in broadband, 1999–2006

Period	Cable modem service	Telecommunications DSL
Before 2003 1Q	Unregulated	Title II with "line sharing" obligation
2003 1Q to 2005 3Q	Unregulated	Title II but no "line sharing"
2005 3Q and after	Unregulated	Deregulated

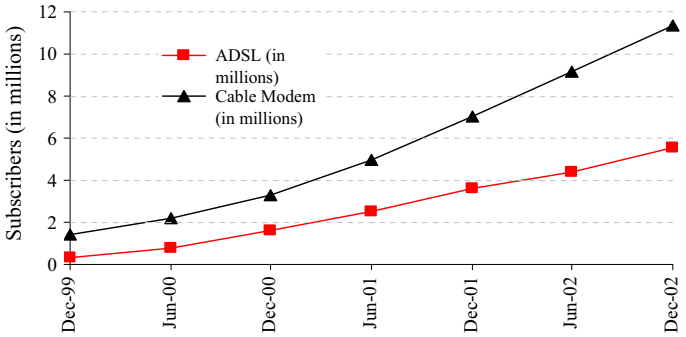

Fig. 5 Cable modem versus DSL subscribership, 1999–2002. *Source*: Hazlett and Caliskan (2008)

access (Fig. 6). In 2005 (third quarter), when the FCC further deregulated DSL service, subscribership growth increased again (relative to previous growth and contemporaneous cable modem gains, Fig. 7).

Hazlett and Caliskan (2008) examined regressions explaining the growth of DSL subscribership, relative to cable modem growth, and incorporated Canada's DSL subscribership as an explanatory factor. Market structure in Canada as similar to the U.S., but operated under an independent regulatory format. The observed pattern was that DSL subscribership registered statistically significant upward shifts, deviating from trend, in both 2003 and 2005. The implication was that Title II requirements were negatively associated with broadband subscriber growth. Indeed, year-end 2006 DSL subscribership was 65% higher than would be predicted by the pre-deregulation trend (through 2002). The increase was about ten million households.

The FCC OIO2 also claims that, in addition to supporting DSL deployments, Title II regulation is responsible for expanding fiber-based broadband networks. If

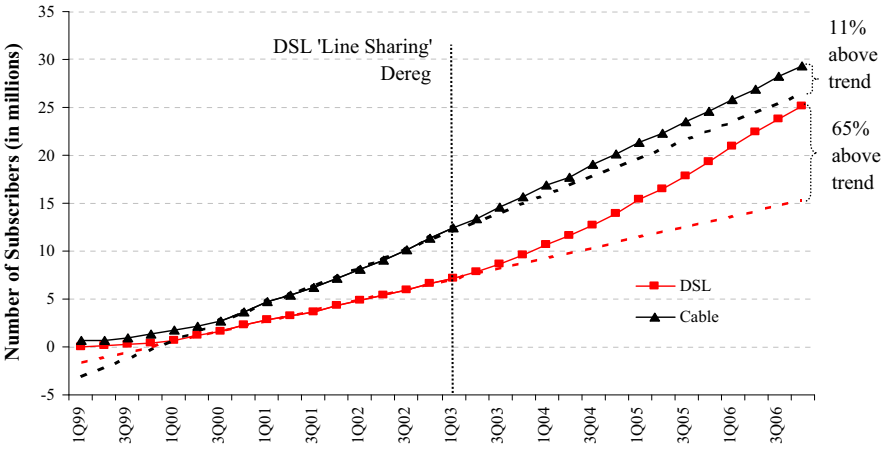

Fig. 6 CM and DSL subscriber growth (2003-1Q deregulation)

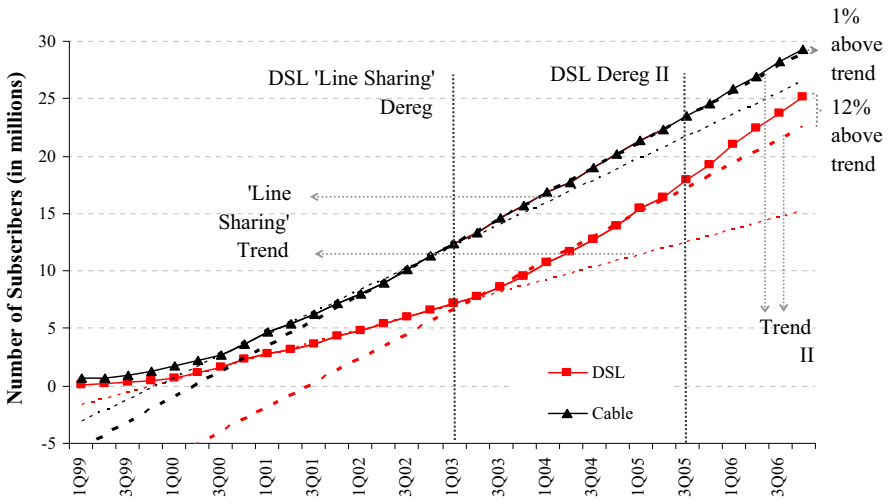

Fig. 7 CM and DSL subscriber growth (2005-3Q deregulation)

true, this assertion would contradict the prediction that the FCC made in October 2004 after it removed Title II unbundling requirements for fiber-to-the-node networks (which, of course, include fiber-to-the premises (FTTP) configurations). As the Commission wrote in its 2004 semi-annual report on high-speed services: The FCC "today voted to further build on its policies designed to spark deployment of new fiber optic networks capable of providing advanced data, video and voice services to consumers" (FCC 2004). The Commission said it was eliminating common carrier rules to reduce "roadblocks to broadband deployment" and to remove "obligations [that] discouraged incumbent carriers' investment in FTTH broadband facilities" (*Id.*).

This deregulation occurred when there were virtually no FTTP subscribers in the United States. Yet, deployments quickly emerged (Fig. 8). By mid-2008, there were over 2.5 million FTTP subscribers, and there were 7.2 million by year-end 2013. Whether deregulation caused the increase in FTTP subscriptions, as asserted by the

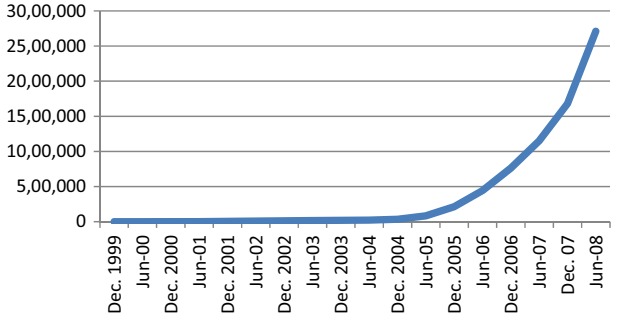

Fig. 8 Residential FTTP subscribers in U.S. (FCC data)

FCC originally predicted, can be debated. At a minimum, however, deregulation did not appear to diminish FTTP deployment. Moreover, a 2004 private sector forecast suggests a strong link. Gartner explicitly increased its projections for fiber optic sales (as inputs used in FTTP deployments) to take account of the FCC deregulation, which was thought to result in expanded investments in fiber broadband systems.[6] That, of course, is consistent with both the FCC forecast and the observed time trend for subscribership after 2004.

4 Mobile License Auction Bids

> Finally, the recent AWS auction, conducted under the prospect of Title II regulation, generated bids (net of bidding credits) of more than $41 billion – further demonstrating that robust investment is not inconsistent with a light-touch Title II regime (FCC 2015a, par, 40; footnotes omitted).

The bids for AWS-3 licenses in FCC Auction 97 were notably higher than the FCC expected. Prices per MHz per person averaged $2.68, which were more than twice that paid in the 2008 700 MHz auction (Auction 73) and higher than in any other auction with the exception of Auction 35 in 2005—where the bids registered were not collected by the government due to legal problems that were associated with the Personal Communications Services C Block licenses (Fig. 9). The Commission claims that the high AWS-3 bids demonstrate that Title II does not deter investment incentives as per these prices.

Of course, there are alternative explanations, some suggested by the Commission itself. The FCC established in 2010 that the wireless market, exhibiting a "mobile data tsunami," would need to access another 300 MHz by 2015 in order to support projected growth in data services (FCC 2010). Yet, the FCC failed to release the bandwidth. By mid-2015, following the AWS-3 auction, less than 100 MHz of additional mobile spectrum had entered the marketplace.[7] Hence, the Commission's analysis would imply that the demand for CMRS licenses would be particularly strong, given supply, by the time that Auction 97, the first major FCC sale of licenses since 2008, was held.

Moreover, when the auction was held there was no network neutrality regulation. The D.C. Circuit vacated the FCC's 2010 OIO1 on January 24, 2014 in the *Verizon v. FCC* opinion. Auction 97 began on Nov. 13, 2014 and ended on Jan. 29, 2015. Bidders knew that the FCC was moving to advance a new rulemaking on matter, but the Commission surprised most experts when it unveiled its Title II rules via an article by FCC Chair Tom Wheeler that was published on Feb. 4, 2015 in Wired Magazine (Wheeler 2015). Indeed, the policy reveal was reported as a stunning

[6] Gartner Consulting, *One Gigabit or Bust Roundtable* Presentation (Nov. 15, 2004); http://www.cenic.org/events/archives/1gob/112004/mgilbertpres.pdf.

[7] The FCC identified 547 MHz as available to mobile carriers in 2010. In May 2015, some 645 MHz were available (Bazelon and McHenry 2015, p. 8).

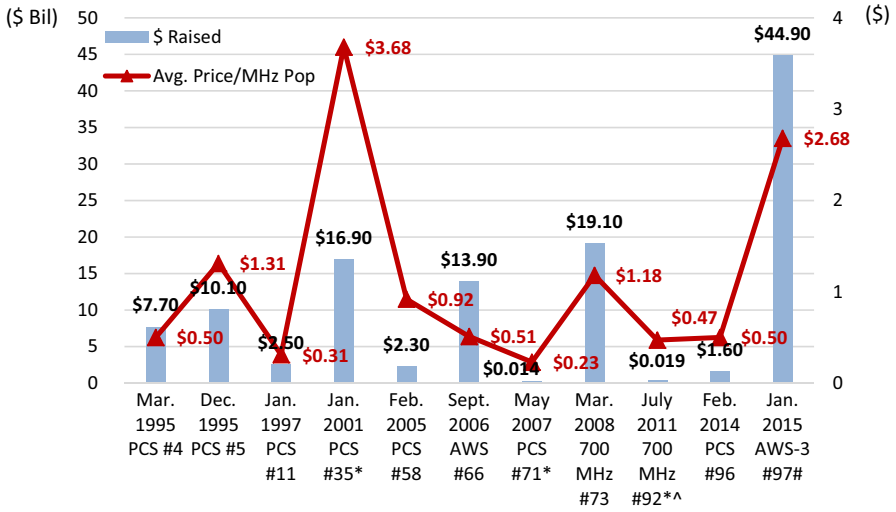

Fig. 9 Revenues and mean prices in FCC CMRS auctions. [*Source*: Kagan (2015). *Asterisk* (*) Re-auction; *Circumflex Accent* (^) mean price excludes Puerto Rico licenses; *Number sign* (#) total gross revenues (not reflecting bidding discounts) and price for paired spectrum only]

reversal of previous plans: "Wheeler Goes Nuclear with Title II Announcement," as Wireless Week reported that same day (Berg 2015).

Before the Title II rules were imposed on broadband services, the FCC had taken the position that mobile services should be treated much more leniently under network neutrality rules. This was a key feature of the FCC's 2010 rules. Were market competitors to believe that this paradigm might continue in the next effort by policy makers, it is possible that demand for CMRS licenses might increase due to an effort to substitute capital spending (and network deployments) away from more heavily regulated market segments. This would appear to reflect the pattern that was seen in the early broadband market, where unregulated cable modem services were more aggressively deployed than common carrier DSL services.

Whatever the expectations with respect to the nature of potential "open Internet" rules as of January 2015, it was likely that any newly imposed regulatory obligations were several years away. A prominent industry analyst wrote in February 2015, after commenting on an effort by "the Republican-dominated Congress… to push through legislation that proposes an alternative Net Neutrality solution," that "[a]ll sides assume Net Neutrality will precipitate years of legal wrangling" (Kagan 2015, p. 6).

While there is little evidence that market bids incorporated information about Title II, and no way to differentiate between license values that differed only with respect to such regulatory burdens, the FCC ignores other evidence which reflected just such an outcome. In Auction 73, held in 2008, the FCC offered a range of CMRS licenses, including those covering the C Block, where the authorizations uniquely included "open access" requirements. Verizon, which emerged the victorious bidder for the C block licenses, gained access to 22 MHz of essentially

Table 3 Mean prices paid in FCC auction 73 (2008)

Block	A	B	C
Bandwidth (MHz)	12	12	22
Type	Paired	Paired	Paired
# of licenses	176	734	12
Impairments	Adjacent TV broadcasts	None	none
Mean price/MHz/pop	$1.16	$2.68	$0.76

nationwide spectrum at a price of about $4.75 billion. The price of other licenses, allocated adjacent (and highly similar) spectrum that did not include the open access requirement, sold for about twice as much (Table 3). It has been commonly believed that the C block prices were "kept low by the open access conditions imposed by the FCC…" (Ferrar 2012; see also Bennett 2012).

Other factors may account for some, if not all, of the observed price difference. Ford et al. (2008) calibrated a regression model incorporating license prices from the two largest auctions to that time (Auctions 66 and 73), and then predicted the C block prices in the absence of special regulatory requirements. This exercise suggested a range of $7.9 billion to $9 billion in total payments, or 66–89% more than what Verizon paid. The analysis attributes the substantial discount to the "open platform mandate" (*Id*., p. 13). Bazelon (2009) believes that the winning C block prices were about $5 billion below what a more efficiently designed license allocation would have produced, but does not claim to disentangle the price "delta" that was attributable to regulation from the winning bids that would obtain "in an otherwise well designed auction" (*Id.*, p. 120).

5 Conclusion

The Commission sought to make two broad, important arguments that were at least facially grounded in empirical evidence to support its re-imposed Title II regulations on broadband networks. The first was that it was not imposing a major change in the regulatory overhead that many operators, including wireless carriers, already faced under "light touch" regulation that had been in force for decades. The second was to frame several historical episodes of mandated common carriage as positively promoting communications infrastructure.

The FCC's arguments do not stand up to scrutiny. Broadband capital investment did not rise, as asserted by the Commission, after the imposition of the 2010 network neutrality Order. Adjusting simply for inflation, the three-year period (2011–2013) that is cited by the Commission as evidencing an increase in capital spending was actually lower than all but three of the other 15 periods (using 3-year rolling averages) since 1998. Adjusting for GDP or the level of the U.S. stock market, allowing for a more nuanced appraisal than that undertaken by the Commission, demonstrates a similar pattern.

Further, Commission arguments attempted to establish that previous use of Title II regulation had resulted in robust mobile market growth, while the historical fact is

that Title II price controls were eliminated—demonstrating the failure of regulatory constraints—during the period in question. Moreover, the cause of the mobile market expansion that did occur was due to increased competition; a product of enhanced spectrum allocations that occurred under a policy described by the FCC at the time as complete deregulation.

In yet another empirical offering from the Commission, it was argued that the 2015 auction of AWS-3 licenses garnered high prices despite (if not because of) network neutrality rules. In fact, such rules were not in place and the prices bid offered no evidence of the proffered relationship. In a previous auction, held in 2008, "open access" requirements were imposed on particular licenses, however. The result was that valuations were far lower than for licenses where the regulatory restrictions were not imposed. See Table 4 for a summary.

Perhaps most dramatic are the results seen in broadband markets where policy variability has revealed market reactions to common carrier regulation. When cable modem services developed in the 1990s, they were unregulated and out-performed DSL, as the FCC observed. This deployment difference was the predicate for removing telephone network sharing and Title II requirements in 2003–2005. Markets quickly reacted. Enhanced broadband deployment was observed for DSL and fiber optic technologies, and competitive network performance dramatically improved.

As this paper was undergoing final editing in November 2016, a U.S. electoral "Black Swan" occurred. The January 2017 presidential inauguration now brings a shift from Democratic to Republican administration. Given that the 2015 OIO was adopted on a 3–2 vote, with the two Republican Commission members dissenting, and the coming FCC will feature a 3–2 partisan divide in the opposite direction, the probability is substantial that broadband regulations will again change. Separating

Table 4 Summary of FCC evidence

Test	FCC assertion	Evaluation	Empirical evidence supports/rejects NN
Broadband ISP capex	ISP investment rose to record levels following 2010 OIO1	Effects eliminated by adjusting for inflation, GDP or stock market growth	Rejects
Mobile Services growth	Market grew under "light touch" common carrier rules, 1993–2009	Cellular rate regulation did not lower rates, enhanced spectrum allocation did	Rejects
DSL and FTTP deployment	Wired broadband access grew under Title II rules	DSL and FTTP subscribership both increased rapidly with Title II *de*regulation	Rejects
Mobile license values	AWS-3 bids ($41.5B) reflected zero or positive impact of Title II rules	AWS-3 provided no test of regulation; 700 MHz C Block did, revealing ~40% discount	Rejects

the economic impacts will still prove challenging. As one sector analyst, long associated with the cable TV industry, commented after the election:

> And the fate of "net neutrality"? …. at the end of the day we will still be assuring neutrality in delivery. That's never been the major issue. It's always been about "Title II" common carrier status. That will go away, and very few folks will ever notice the difference (Effros 2016).

The analysis provided in this paper is not intended to provide a comprehensive investigation of the panoply of common carrier rules in broadband (or wireless) markets that might warrant or benefit from cost-benefit analysis. Rather, we intend to provide straightforward economic assessments of the key empirical assertions that the FCC made when it attempted to advance the case for Title II rules in the 2015 OIO2. We hope that this might provoke further evaluation of the efficacy of broadband network regulation.

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References

Bazelon, C. (2009). Too many goals: Problems with the FCC's 700 MHz auction. *Information Economics and Policy, 21*(2), 115–127.

Bazelon, C., & McHenry, G. (2015). *Mobile broadband spectrum: A vital resource for the American economy*. White Paper for CTIA, May 11.

Bennett, R. (2012). *The 700 MHz device subsidy plan*. High Tech Forum, March 30. http://hightechforum.org/the-700-mhz-device-subsidy-plan/.

Berg, A. (2015). *Update: Wheeler goes nuclear with Title II announcement*. Wireless Week (February 4); https://www.wirelessweek.com/news/2015/02/update-wheeler-goes-nuclear-title-ii-announcement.

Boliek, B. E. L. (2009). Wireless net neutrality regulation and the problem with pricing: An empirical, cautionary tale. *Michigan Telecommunications & Technology Law Review, 16*(1), 1–52.

Brand X. (2005). *National cable and telecommunications Assn. v. Brand X internet services*. 545 U.S. 967.

Brock, G. W. (1986). *Telephone pricing to promote universal service and economic freedom.* OPP Working Paper Series No. 18, January.

Comcast. (2010). *Comcast corp. v. FCC*. 600 F.3d 642 (D.C. Cir.).

Comstock, E. W., & Butler, J. W. (2000). Access denied: The FCC's failure to implement open access to cable as required by the communications act. *CommLaw Conspectus, 8*(1), 5–22.

Cooper, J. C., Froeb, L. M., O'Brien, D., & Vita, M. G. (2005). Vertical antitrust policy as a problem of inference. *International Journal of Industrial Organization, 23*(7–8), 639–664.

DOJ. (2010). *United States Department of Justice, Antitrust Division, Ex Parte Submission to the Federal Communications Commission*. Docket No. 09-51, January 4.

Duso, T. (2005). Lobbying and regulation in a political economy: Evidence from the U.S. cellular industry. *Public Choice, 122*(3), 251–276.

Effros, S. (2016). *Now what*? CableFaxDaily 4, November 17.

Esbin, B. (1998). *Internet over cable: Defining the future in terms of the past*. Federal Communications Commission, OPP Working Paper No. 30, August.

Faulhaber, G. R. (2015). What Hath the FCC Wrought? *Regulation, 38*(2), 50–55.

FCC. (1999). *Broadband today*. Staff Report to William E. Kennard, Chairman of the Federal Communications Commission, October.

FCC. (2002). *Federal Communications Commission, In the matter of inquiring concerning high-speed access to the internet over cable and other facilities, declaratory ruling and notice of proposed rulemaking*. GN Docket No. 00-185, March 15.

FCC. (2004). *Federal Communications Commission, FCC removes more roadblocks to broadband deployment in residential neighborhoods*. News Release, October 14.
FCC. (2010). *Federal Communications Commission, national broadband plan, chapter five: Spectrum*, March.
FCC. (2011). *Federal Communications Commission, In the matter of connect America fund: Report and order and further notice of proposed rulemaking*. WC Docket No. 10-90, November 18.
FCC. (2015a). *Federal Communications Commission, In the matter of protecting and promoting the open internet: Report and order on remand, declaratory ruling, and order*. GN Docket No. 14-28, March 12.
FCC. (2015b). *Federal Communications Commission, In the matter of protecting and promoting the open internet: Report and order on remand, declaratory ruling, and order*. GN Docket No. 14-28 (Title II Order) (Dissenting Statement of Commissioner Ajit Pai), March 12.
Ferrar, T. (2012). *Verizon is selling spectrum, but is anyone buying?* GigaOm. https://gigaom.com/2012/05/05/verizon-is-selling-its-spectrum-but-is-anyone-buying/, May 5, 2012.
Ford, G. S., Koutsky, T. S., & Spiwak, L. J. (2008). *Using auction results to forecast the impact of Wireless Carterfone regulation on wireless networks*. Phoenix Center Policy Bulletin No. 20, March.
Frieden, R. (2008). *Wireless carterfone: A long overdue policy promoting consumer choice and competition*. New America Foundation Wireless Future Program, Working Paper #20, January.
GAO. (2012). *Government Accountability Office, Report to congressional requester, FCC has reformed the high-cost program, but oversight and management could be improved*, July.
Goolsbee, A. (2007). *Vertical integration and the market for broadcast and cable television programming*. Media Study for the Federal Communications Commission. https://apps.fcc.gov/edocs_public/attachmatch/DA-07-3470A10.pdf, April.
Hahn, R. W., Litan, R. E., & Singer, H. J. (2007). The economics of 'wireless net neutrality'. *Journal of Competition Law and Economics, 3*(3), 399–452.
Hausman, J. (2002). Mobile telephone. In M. Cave, S. Majumdar, & I. Vogelsang (Eds.), *Handbook of telecommunications economics* (pp. 564–604). Amsterdam: Elsevier Science.
Hazlett, T. W. (2003). Is federal preemption efficient in cellular phone regulation? *Federal Communications Law Journal, 56*(1), 155–238.
Hazlett, T. W., & Caliskan, A. (2008). Natural experiments in broadband regulation. *Review of Network Economics, 7*(4), 460–480.
Hazlett, T. W., & Wright, J. D. (2012). The law and economics of network neutrality. *Indiana Law Review, 45*(3), 767–840.
Huber, P. W., & Leo, E. (1997). The incidental, accidental deregulation of data and everything else. *Industrial and Corporate Change, 6*(4), 807–828.
Hundt, R. (1999). *You say you want a revolution*. New Haven: Yale University Press.
Kagan. (2015). *Can the FCC attract a full house for the 2016 broadcast incentive auction*? Kagan Media Appraisals, February 11.
Katz, M. L. (1983). Non-uniform pricing, output and welfare under monopoly. *Review of Economics Studies, 50*(1), 37–56.
Katz, M. L. (1984). Price discrimination and monopolistic competition. *Econometrica, 52*(6), 1453–1471.
Katz, M. L. (1987). The welfare effects of third-degree price discrimination in intermediate good markets. *American Economic Review, 77*(1), 154–167.
Katz, M. L. (2016). *Wither the open internet order?* Working Paper.
Kellogg, M. K., Huber, P. W., & Thorne, J. (1999). *Federal telecommunications law gaithersburg*. Gaithersburg, MD: Aspen Law & Business.
Lafontaine, F., & Slade, M. (2007). Vertical integration and firm boundaries: The evidence. *Journal of Economic Literature, 45*(3), 629–685.
Manne, G., & Wright, J. D. (2010). Innovation and the limits of antitrust. *Journal of Competition Law & Economics, 6*(1), 153–202.
Owen, B. M. (2011). Antitrust and vertical integration in "New Economy" industries with application to broadband access. *Review of Industrial Organization, 38,* 363–386.
Oxman, J. (1999). *The FCC and the unregulation of the internet, federal communications commission*. OPP Working Paper No. 31, July.
Pai, A. (2016). *Remarks of FCC Commissioner Ajit Pai before the Heritage Foundation. The FCC and internet regulation: A first-year report card*, February 26.

Picot, A., & Wernick, C. (2007). The role of government in broadband access. *Telecommunications Policy, 31*(10–11), 660–674.

Rosston, G. L., & Wallsten, S. J. (2014). The broadband stimulus: A rural boondoggle and missed opportunity. *Information Society Journal of Law & Policy, 9*(3), 453–470.

Shew, W. (1994). Regulation, competition, and prices in the U.S. cellular telephone industry. In *ENSAW-CREST conference on the economics of radio-based communications*, 41, June 23–24.

United States Telecom Ass'n. (2016). *United States Telecom Ass'n v. FCC*, 825 F.3d 674 (D.C. Cir.).

United States Telecom Ass'n (Williams, J., dissenting). (2016). *United States Telecom Ass'n v. FCC*, 825 F.3d 744 (D.C. Cir.) (Williams, J., dissenting).

Verizon. (2014). *Verizon v. FCC*, 740 F.3d 623 (D.C. Cir.).

Wheeler, T. (2015). *This is how we will insure net neutrality*. WIRED, https://www.wired.com/2015/02/fcc-chairman-wheeler-net-neutrality/. February 4.

Wright, J. D. (2015). Remarks of FTC Commissioner Joshua D. Wright before the federalist society media and telecommunications practice group event: The future of media—Is government regulation in today's media landscape "over-the-top"? *Net Neutrality Meets Regulatory Economics*, 101, February 25.

Wu, T. (2007). Wireless carterfone. *International Journal of Communication, 1,* 389–426.

Wu, T., & Yoo, C. (2007). Keeping the internet neutral? Tim Wu and Christopher Yoo Debate. *Federal Communications Law Journal, 59*(3), 575–592.

Yoshida, Y. (2000). Third degree price discrimination in input markets: Output and welfare. *American Economic Review, 90*(1), 240–246.